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## PATENT SPECIFICATION (11)

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- (21) Application No. 12729/75 (22) Filed 26 March 1975 (19)  
 (31) Convention Application No. 7 412 954 (32) Filed 12 April 1974 in  
 (33) France (FR)  
 (44) Complete Specification published 5 Oct. 1977  
 (51) INT. CL.<sup>2</sup> E21B 43/12  
 (52) Index at acceptance  
 EIF 44  
 (72) Inventor HUBERT MIFFRE



## (54) CONTROLLABLE SAFETY CAP FOR OIL AND OR GAS WELL

- (71) We, ENTREPRISE DE RECHERCHES ET D'ACTIVITES PETROLIERES (ELF), a French Body Corporate, of 7, Rue Nelaton, 75739 Paris, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 This invention relates to a safety cap for capping and uncapping an oil and or gas well.
- 15 According to the invention we provide a controllable safety cap for capping and uncapping an oil and or a gas well, said safety cap having an open top chamber adapted to be connected to an anchoring member, side ports in the said open top chamber, a first cylinder in said safety cap containing a movable piston assembly connected to a first valve having an upper and a lower seat said valve being disposed in said open top chamber, said valve stopping the flow of oil and or gas via said ports when on its upper seat and opening them to the said flow when on its lower seat; a pressure fluid conduit feeding the top end of the first cylinder and a second cylinder within said piston assembly, means allowing fluid communication between top and bottom surfaces of the said first valve when pressure fluid is applied via said pressure fluid conduit to the second cylinder and a compression spring in the first cylinder able to move the said first valve to the said upper seat of the open top chamber to cap the well unless pressure is applied via the said pressure fluid conduit.
- for positioning an anchoring member 3 which is connected to a safety cap 4. Seals 5 are interposed between the tubing 1 and the anchoring member 3. The safety cap 4 is connected with the anchoring member 3 via threaded portions at P1 and sealed with sealing rings P2, P3. The safety cap 4 has an open top chamber 4T with ports 7 providing communication between the downstream part 1D of said tubing and the upstream part 1U which is within the anchoring member 3, the surface ground of the oil or gas well being assumed to be at GG1. The downstream access to the ports 7 and to the interior 1U of the anchoring member 3 is equal to or greater than the passage section of the ports 7 and the passage section of the anchoring member 3.
- A first valve 8 in the safety cap 4 can occupy two positions, a first position that opens the ports 7 (as shown in the Figure) when the lower surface of the valve 8 is on its lower seat 4B and a second position that closes said ports 7, the upper surface of the valve 8 bearing on an upper valve seat 4A.
- The first valve 8 is connected to a movable piston assembly shown generally at 10 said piston assembly comprising a first piston 11 sliding in a first cylinder 12 in the safety cap which first piston 11 is biased by a first helical compression spring 13 toward GG1. A second piston 14 slides in a second cylinder 11A in the first piston 11 and controls a second valve 16 via a rod 15, second valve 16 being disposed in the first valve 8. A second helical compression spring 17 urges second piston 14 upwards toward GG1 to close on opening to the

## SPECIFICATION NO 1487803

By a direction given under Section 17 (1) of the Patents Act 1949 this application proceeded in the name of SOCIETE NATIONALE ELF AQUITAINE (PRODUCTION), a French Body Corporate, of Tour Aquitaine, 92400—Courbevoie, France.

THE PATENT OFFICE

Bas 43503/3

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- 10 This invention relates to a safety cap for capping and uncapping an oil and or gas well.
- 15 According to the invention we provide a controllable safety cap for capping and uncapping an oil and or a gas well, said safety cap having an open top chamber adapted to be connected to an anchoring member, side ports in the said open top chamber, a first cylinder in said safety cap containing a movable piston assembly connected to a first valve having an upper and a lower seat said valve being disposed in said open top chamber, said valve stopping the flow of oil and or gas via said ports when on its upper seat and opening them to the said flow when on its lower seat; a pressure fluid conduit feeding the top end of the first cylinder and a second cylinder within said piston assembly, means allowing fluid communication between top and bottom surfaces of the said first valve when pressure fluid is applied via said pressure fluid conduit to the second cylinder and a compression spring in the first cylinder able to move the said first valve to the said upper seat of the open top chamber to cap the well unless pressure is applied via the said pressure fluid conduit.
- 20 The invention will be more readily understood from the following description of the single figure of the accompanying drawing which illustrates one embodiment of a safety cap of the invention by way of example only.
- 25 Referring to the figure of the drawing, gas and or oil well tubing 1 is provided with a welded internally threaded sleeve 1A and has interposed therein a threaded sleeve 2 for positioning an anchoring member 3 which is connected to a safety cap 4. Seals 5 are interposed between the tubing 1 and the anchoring member 3. The safety cap 4 is connected with the anchoring member 3 via threaded portions at P1 and sealed with sealing rings P2, P3. The safety cap 4 has an open top chamber 4T with ports 7 providing communication between the downstream part 1D of said tubing and the upstream part 1U which is within the anchoring member 3, the surface ground of the oil or gas well being assumed to be at GG1. The downstream access to the ports 7 and to the interior 1U of the anchoring member 3 is equal to or greater than the passage section of the ports 7 and the passage section of the anchoring member 3.
- 30 A first valve 8 in the safety cap 4 can occupy two positions, a first position that opens the ports 7 (as shown in the Figure) when the lower surface of the valve 8 is on its lower seat 4B and a second position that closes said ports 7, the upper surface of the valve 8 bearing on an upper valve seat 4A.
- 35 The first valve 8 is connected to a movable piston assembly shown generally at 10 said piston assembly comprising a first piston 11 sliding in a first cylinder 12 in the safety cap which first piston 11 is biased by a first helical compression spring 13 toward GG1. A second piston 14 slides in a second cylinder 11A in the first piston 11 and controls a second valve 16 via a rod 15, second valve 16 being disposed in the first valve 8. A second helical compression spring 17 urges second piston 14 upwards toward GG1 to close an aperture 18 in first valve 8 that provides communication between top and bottom surfaces of the first valve 8 via first ducts 19. First piston 11 has an extension 11B containing a second duct 22 that provides communication between the second cylinder 11A and the tubing at 1D. Ports 20 in an extension 11C of the first piston 11 provide communication between the first cylinder 12 and the top surface of the second piston 14.

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Propellant is introduced via a pressure fluid conduit 21 that extends through sleeve 2, anchoring member 3 and safety cap 4 into the top end 12A of first cylinder 12 said propellant fluid (air, water or oil) under pressure exerts a pressure directly on the top surface of the first piston 11 and a pressure via port 20 on the top surface of second piston 14.

The pressure of the fluid counterbalances the action of the first and second helical springs 13 and 17 so that the movable piston assembly 10 is forced with its bottom surface on seat 4B of cap 4 as shown in the Figure; the ports 7 are now open. A reduction in the fluid pressure of the propellant in the passageway 21 allows the force of the first helical spring 13 to urge the first valve 8 to rest with its top surface against valve seat 4A so that the ports 7 are closed. The first helical spring 13 is designed to have an inch rate such as to be able to force the first valve 8 to close the ports 7 when the gas or oil well is not delivering, and against the pressure of the propellant fluid.

In operation, the tubing 1 is filled with a column of effluent (gas and or oil under pressure) rising from downstream 1D to upstream 1U. Closure of the safety cap 4 is effected from the ground surface GG1 by reducing the fluid pressure of the propellant in the pressure fluid conduit 21 and hence in the first cylinder 12, so that the movable piston assembly 10 slides upwards as a result of expansion of the first helical compression spring 13 and the pressure of the effluent on the exposed area of the extension 11B of first piston 11 and on the area of second piston 14 produced via the second duct 22. The first valve 8 is thereby forced to its seat 4A and this closes the ports 7 so that hydraulic communication between the upstream part 1U and the downstream part 1D of the tubing 1 is prevented.

To open the safety cap 4, the pressures on either side of the first valve 8 must be equalised by opening the aperture 18 via second valve 16, and this is again effected from the ground surface GG1 by increasing the pressure of the propellant fluid in the pressure fluid conduit 21, so that the fluid forces the second piston 14 against second helical compression spring 17 which opens the aperture 18 via second valve 16 and rod 15, and thus the effluent pressure is equalised on the top and bottom surfaces of the first valve 8 via the first ducts 19. The propellant fluid also acts on the first piston

11, which moves downwards and opens the first valve 8. Aperture 18 via second valve 16 closes again and the safety cap 4 is ready for a fresh closure operation.

#### WHAT WE CLAIM IS:—

1. A controllable safety cap for capping and uncapping an oil and or a gas well, said safety cap having an open top chamber adapted to be connected to an anchoring member, side ports in the said open top chamber, a first cylinder in said safety cap containing a movable piston assembly connected to a first valve having an upper and a lower seat said valve being disposed in said open top chamber, said valve stopping the flow of oil and or gas via said ports when on its upper seat and opening them to the said flow when on its lower seat; a pressure fluid conduit feeding the top end of the first cylinder and a second cylinder within said piston assembly, means allowing fluid communication between top and bottom surfaces of the said first valve when pressure fluid is applied via said pressure fluid conduit to the second cylinder and a compression spring in the first cylinder able to move the said first valve to the said upper seat of the open top chamber to cap the well unless pressure is applied via the said pressure fluid conduit.

2. The controllable safety cap according to claim 1, wherein the means allowing communication comprises first ducts which provide fluid communication between the top and bottom surfaces of the said first valve.

3. The controllable safety cap according to claim 2, wherein a second valve co-operating with said first ducts in the said first valve is actuated by a rod connected to a second piston, said second piston sliding in the second cylinder against a spring, a second duct being provided between the bottom end of the said second piston and the bottom end of the first piston, and ports at the top end of the second cylinder, said ports communicating with the first cylinder in respect of said pressure fluid.

4. A controllable safety cap, for capping an oil and or a gas well, constructed and arranged substantially as described herein and shown in the figure of the accompanying drawing.

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